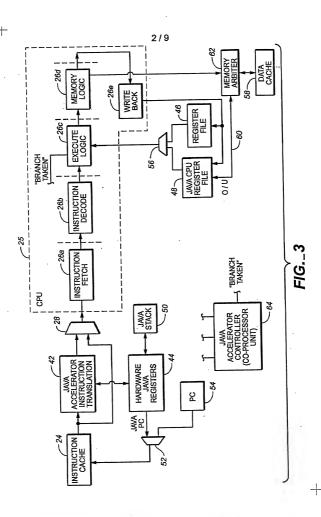
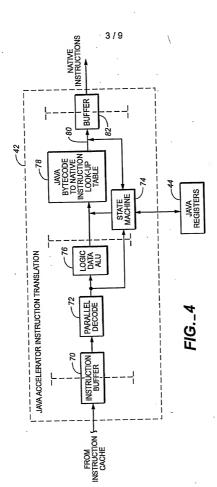


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## INSTRUCTION TRANSLATION NATIVE JAVA INSTRUCTION BYTECODE ADD R1, R2 iadd II. JAVA REGISTER PC = VALUE A + 1 PC = VALUE A OPTOP = VALUE B - 1 OPTOP = VALUE B (R2) (R1) VAR = VALUE C VAR = VALUE C III. JAVA CPU REGISTER FILE R0 0001 NOT A VALID STACK VALUE → R1 0150 CONTAINS VALUE → R1 0150 CONTAINS VALUE → R2 1360 OF TOP OF OPERAND STACK R2 1210 OF THE TOP OF R3 0007 R3 0007 OPERAND STACK R4 0005 R4 0005 R5 0006 R5 0006 R6 1221 CONTAINS FIRST → R6 1221 VARIABLE R7 1361 R7 1361 IV. MEMORY OPTOP = VALUE B → - 0150 OPTOP = VALUE B - 1 -1360 (VALUE B - 1) -1210 0007 0007 0005 0005 0006 0006 0001 0001 4427 4427 VAR = VALUE C - 1221 VAR = VALUE C -1221 1361 1361 - 1101 1101

FIG.\_5

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## I. INSTRUCTION TRANSLATION

JAVA BYTECODE		NATIVE INSTRUCTION
		MOTHOUTION
iload_n	5>	ADD DC D4
iadd		ADD R6, R1
II. JAVA REGISTER		
PC = VALUE A	<i>حا</i> ر	PC = VALUE A + 2
OPTOP = VALUE B	7/	OPTOP = VALUE B
(R1)		(R1) VAR = VALUE C
VAR = VALUE C		VAR = VALUE C
III. JAVA CPU REGISTER FILE		•
R0 0001		R0 0001
CONTAINS → R1 0150	7	CONTAINS → R1 1371
VALUE OF R2 1210 TOP OF	∀.	VALUE OF R2 1210 TOP OF R0 2007
OPERAND STACK R3 0007 R4 0005		STACK R3 0007 R4 0005
R4 0005 R5 0006		R5 0006
CONTAINS FIRST → R6 1221		CONTAINS → R6 1221
VARIABLE R7 1361		FIRST R7 1361 VARIABLE
TV MEMORY		
IV. MEMORY		
OPTOP = VALUE B → - 0150		OPTOP = VALUE B - 1371
- 1210	➾	- 1210 - 0007
- 0007 - 0005	•	- 0007 - 0005
- 0005		- 0006
- 0001		- 0001
- 4427		- 4427
$\approx \approx$		$\approx \sim$
VAR = VALUE C - 1221		VAR = VALUE C - 1221
- 1361		- 1361
- 1101		- 1101

FIG.\_6

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Opcodes Mnemonic	Opcode xHH	Excep Gen
nop	0x00	
aconst_null	x01	
iconst_m1	x02	<u> </u>
iconst_n(0-5)	x03 - x08	
lconst_n(0-1)	x09 - x0a	
fconst_n(0-2)	x0c - x0d	
dconst_n(0-1)	x0e -x0f	
bipush	x10	
sipush	x11	
ldc	x12	У
ldc_w	x13	У
ldc2_w	x14	ý
iload	x15	
lload	x16	
fload	x17	
dioad	x18	
aload	x19	
iload n(0-3)	x1a-x1d	
lload_n(0-3)	x1e - x21	
fload_n(0-3)	x22 - x25	
dload_n(0-3)	x26 - x29	
aload n(0-3)	x2a - x2d	
iaload	x2e	
laload	x2f	
faload	x30	
daload	x31	
aaload	- x32	
baload	x33	
caload	x34	
saload	x35	
istore	x36	
Istore	x37	
fstore	x38	
dstroe	x39	
astroe	x3a	
istore n(0-3)	x3b - x3e	
Istore n(0-3)	x3f - x42	
fstore n(0-3)	x43 - x46	
dstore n(0-3)	x47 - x4a	
astore n(0-3)	x4b - x4e	
iastore		
lastore	x4f	
fastroe	x50	
dastore	x51	
bastore	x52	
	x53	· · · · · · · · · · · · · · · · · · ·
aastore	x54	
castroe	x55	
sastore	x56	

FIG.\_7A

pop	x57	
pop2	x58	
dup	x59	
dup_x1	x5a	
dup_x2	x5b	
dup2	x5c	
dup2_x1	x5d	
dup2_x2	x5e	
swap	x5f	
iadd	x60 .	
ladd	x61	
fadd	x62	у
dadd	x63	y
isub	x64	
Isub	x65	
		<del></del>
fsub	x66	у
dsub	x67	у
imul	x68	
imui	x69	
fmul	хба	у
dmul	x6b	У
idiv	x6c	у
ldiv	x6d	у
fdiv	х6е	у
ddiv	x6f	у
irem	x70	У
Irem :	x71	- у
frem	x72	У
drem	x73	У
ineg .	x74	
ineg	x75	
fneg	x76	У
dneg	x77	У
ishl	x78	
Ishi	x79	
ishr	x7a	
Ishr	x7b	
iushr	x7c	
fushr	x7d	
iand	x7e	
land	x7f	
ior	x80	
ior	x81	i
ixor	x82	<u> </u>
ixor	x83	
linc	x84	
izi	x85	у
i2f	x86	ý
i2d	x87	y
121	x88	y
12f	x89	y
12d	x8a	
LICU	XOZ	<u> </u>

FIG.\_7B

Zi	121	d8x	<del> </del>
12d			У
d2			
d2  x8f y   y   d2  x8f   y   d2  x8f   y   d2  x8f   y   d2  x8f   x90   y			
d2f			У У
IZB			. у
Zec			У
ZS			
Icmp			
Image			
Icripp		x94	У
tempg		x95	
Campl		x96	
Cacing		x97	
Ifeq		x98	
Ifine			
Ifit	ifne		<del> </del>
Ifge	ifit		<del> </del>
figt	ifge .		<del> </del>
Ifle			+
If_cmpeq	ifle		<del>                                     </del>
	if icmpea		
	if icmone		ļ
if acmpge         xa2           if cmpgt         xa3           if cmpgt         xa4           if cmple         xa4           if acmpe         xa5           if acmpne         xa6           goto         xa7           jsr         xa8           ret         xa9           tableswitch         xaa           lookupswitch         xaa           y         iretum           retum         xac           iretum         xad           fretum         xae           dretum         xaf           aretum         xb0           retum         xb1           gestatic         xb2         y           putstatic         xb3         y           getfield         xb4         y           putfield         xb5         y           invokespecial         xb6         y           invokespecial         xb7         y           invokesitatic         xb8         y           invokesitatic         xb8         y           invokesitatic         xb8         y           invokesitatic         xb8         y <td>if icmpit</td> <td></td> <td></td>	if icmpit		
f   cmpgt	if acmode		
If   cmple			
if acmpeq         xa5           if acmpen         xa6           goto         xa7           jsr         xa8           ret         xa9           tableswitch         xaa         y           lookupswitch         xab         y           ireturn         xac         return         return           freturn         xad         return         return         return         xaf           areturn         xb0         return         return         return         return         return         return         y           getstatic         xb2         y         y         putstatic         xb3         y           getfeld         xb4         y         y         putfeld         xb5         y           invokesitic         xb8         y         revokevirual         xb6         y           invokesitatic         xb8         y         revokevirual         xb6         y           invokesitatic         xb8         y         revokevirual         xb6         y           invokevirual         xb6         y         y         xb2         y           invokevirual         xb6         y	if icmole		
If acmpne			
goto		7440	
Fire			
ret			
Tableswitch   Xaa			
Ireturn			
return			у
freturn			
dretum			
aretum xb0 return xb1 gestsatic xb2 y putstatic xb3 y getfeld xb4 y putfield xb5 y invokespecial xb6 y invokespecial xb7 y invokespecial xb6 y invokespecial xb7 y invokespecial xb8 y invokespecial xb9 y invokespecial xb8 y invokespecial xb9 y invokespecial xb0 y inv			
return xb1 getstatic xb2 yputstatic xb3 y getfield xb4 y putfield xb5 y invokevirtual xb5 y invokesytual xb6 y- invokestatic xb8 y invokestatic xb8 y invokeinterface xb9 y xxunsedoox xba y new xbb y y newarray xbb y anewarray xbd y settlestatic xb0 y newarray xbd y			
getstatic         xb2         y           putstatic         xb3         y           getfield         xb4         y           putfield         xb5         y           invokevirual         xb6         y           invokespecial         xb7         y           invokestatic         xb8         y           invokeinterface         xb9         y           exunsedxxx         xba         y           new         xbb         y           newarray         xbc         y           anewarray         xbd         y			
putstatic         xb3         y           getfield         xb4         y           putfield         xb5         y           invokevirtual         xb6         y           invokespecial         xb7         y           invokestatic         xb8         y           invokeinterface         xb9         y           excunsedxxx         xba         y           new         xbb         y           newarray         xbc         y           newarray         xbd         y           newarray         xbd         y			
getfield xb4 y putfield xb5 y putfield xb5 y invokevirtual xb6 y invokespecial xb7 y invokestatic xb8 y invokeitatic xb8 y invokeitatic xb8 y excursedoox xba y ew xbb y ew xbb y ewarray xbb y enewarray xbb y			уу
putfield         xb5         y           invokevirual         xb5         y           invokespecial         xb6         y           invokesatic         xb7         y           invokestatic         xb8         y           invokesinterface         xb9         y           occursedoox         xba         y           new         xbb         y           newarray         xbc         y           anewarray         xbd         y			У
Invokevirtual   xb6			у
Invokespecial		xb5	У
Infokespecial		xb6	y
Invokestatic		xb7	
Invokenterrace		8dx	
xxunsedxxx xba y new xbb y newarray xbc y newarray xbd y		xb9	
new xbb y newarray xbc y anewarray xbd y		xba	
newarray xbc y anewarray xbd y		xbb	
anewarray xbd y			
Provide att			
	rraylength	xbe	ý

FIG.\_7C

athrow	xbf	
checkcast	XDI -	У
instanceof		У
monitorenter	xc1	У
monitorexit	xc2	У
wide	xc3	У
multianewarray	xc4	У
ifnull	xc5	· y
ifnonnull	xc6	у
	xc7	у
goto_w	xc8	
jsr_w	xc9	
ldc quick	xcb	<del></del>
ldc w quick	XCC	<u>y</u>
ldc2_w_quick	xcd	у
getfield quick		у
putfield_quick	xce	у
getfield2_quick	xcf	У
putfield2_quick	xd0	У
getstatic_quick	xd1	У
putstatic_quick	xd2	У
pulstane duick	xd3	У
gtestatic2_quick putstatic2_quick	xd4	у
putsiaucz_quick	xd5	У
invokevirtual_quick	xd6	у
invokenonvirtual_quick	xd7	у
invokesuper_quick	xd8	У
invokestatic_quick	xd9	у
invokeinterface_quick	xda	у
invokevirtualobject_quick	xdb	У
new_quick	xdc	у
anewarray_quick	xde	y.
multinewarray_quick	xdf	y
checkcast_quick	xe0	y
instanceof_quick	xe1	У
invokevirtual_quick_w	xe2	ý
getfield_quick_w	xe3	y
putfield_quick_w	xe4	ý
breakpoint	was	
impdep1	xca	у
impdep2	xfe	у
III, Pacepa	xff	у

FIG.\_7D